Tutorial
H-1000-5327-01-B

RENISHAW
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Plane scanning (CAD)

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Plane scanning (CAD)

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1 Plane scanning (CAD)

1.1 Tutorial pre-requisites

- The student should have completed ‘Introduction to 5-axis measurement and movement techniques’ and ‘Boss / bore scanning considering all 5-axis techniques’ tutorials

1.2 Tutorial objectives

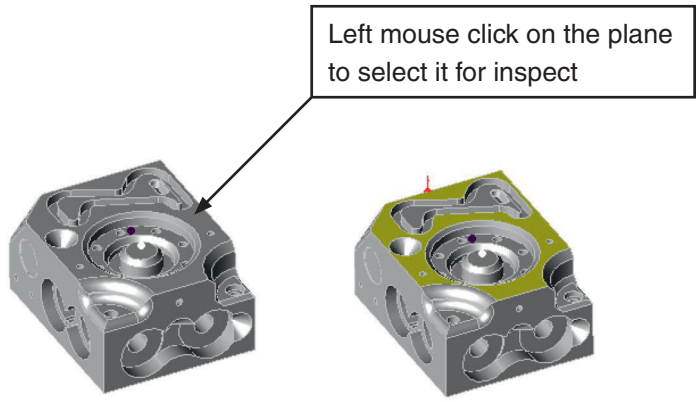
- Further exposure to 5-axis measurement methods / scan path definition specifically for measuring plane features
- Introduce the principles of 5-axis scanning optimisation

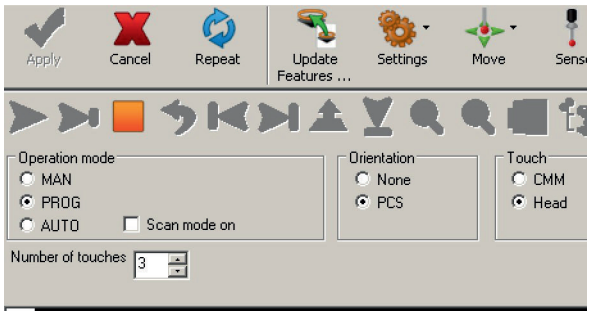
2 Introduction

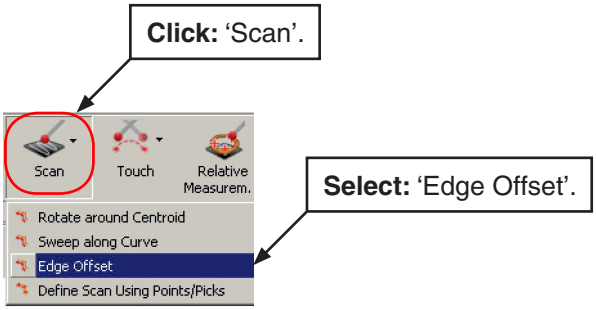
This tutorial further explains the numerous scanning techniques that can be employed using the REVO system. Particular attention is paid to all parameters involved to maximise speed but maintain metrology integrity and reliability.

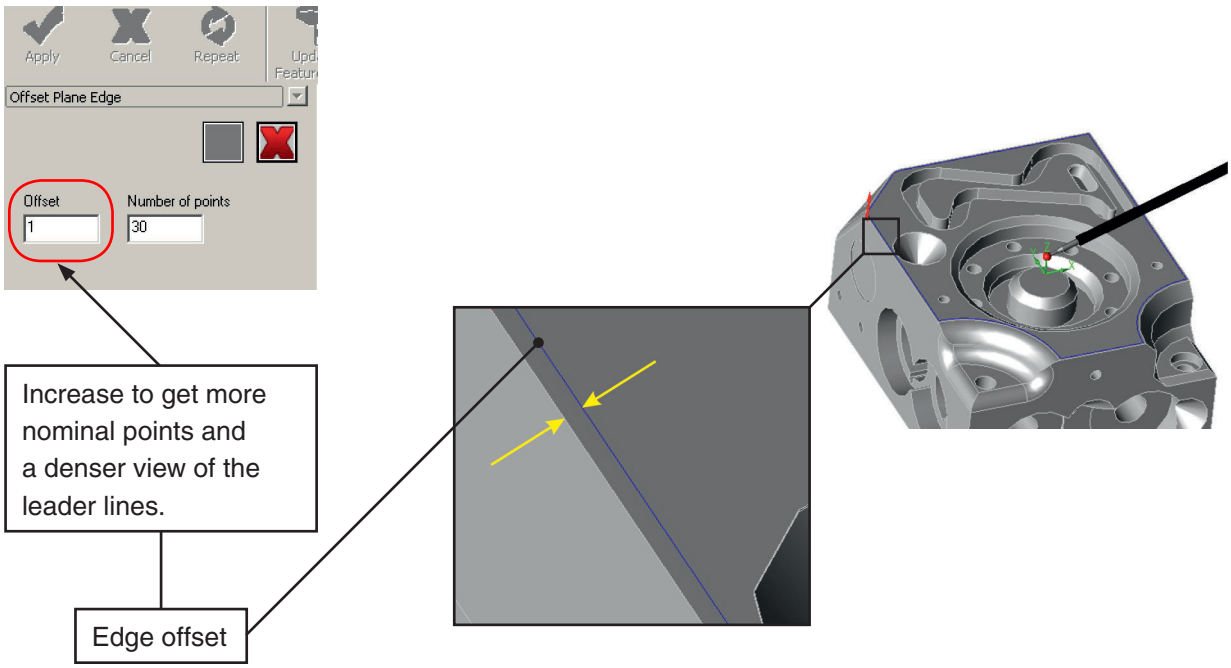
3 Plane scanning using ‘Edge Offset’

Scanning the top face of the training block:







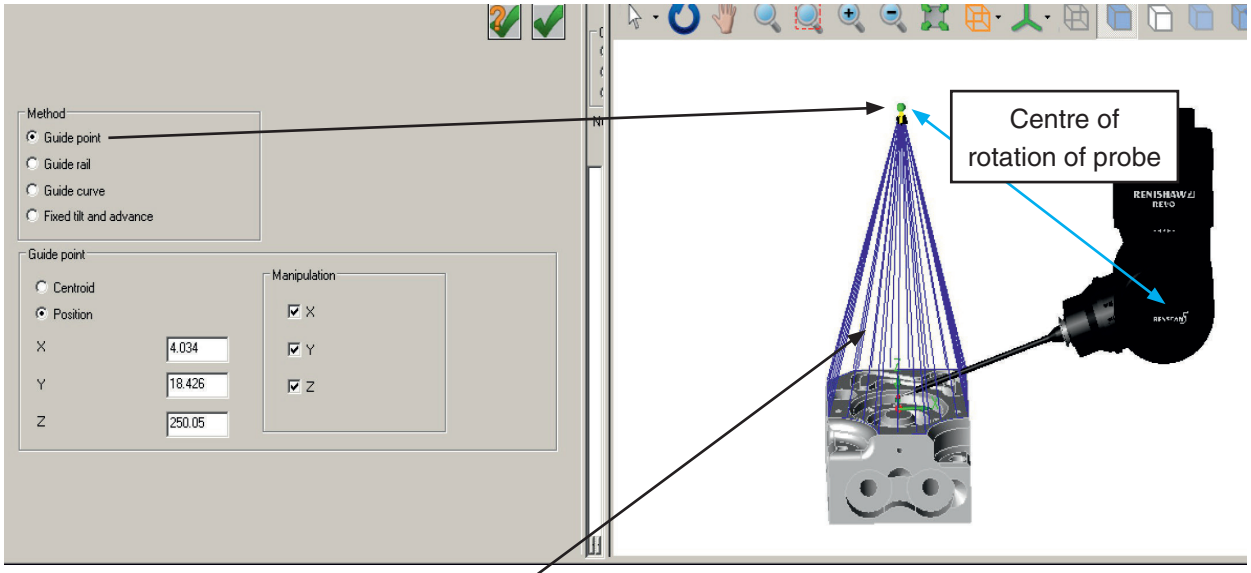


Click one of the plane edges to display the offset. This will allow the green tick to be clicked.

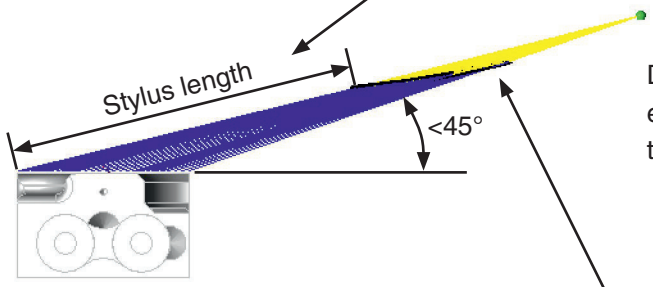
4 ‘Tilt and Advance’ dialogue box - guide point

The ‘Tilt and Advance’ window is now displayed. This set of options is used to define the head orientation relative to the scan path. The first option to be demonstrated will be the ‘Guide Point’ method.

The leader lines converge from the inspection path towards a point, which can be dragged in the model window to adjust the orientation of the probe head on scanning or taking touch points.



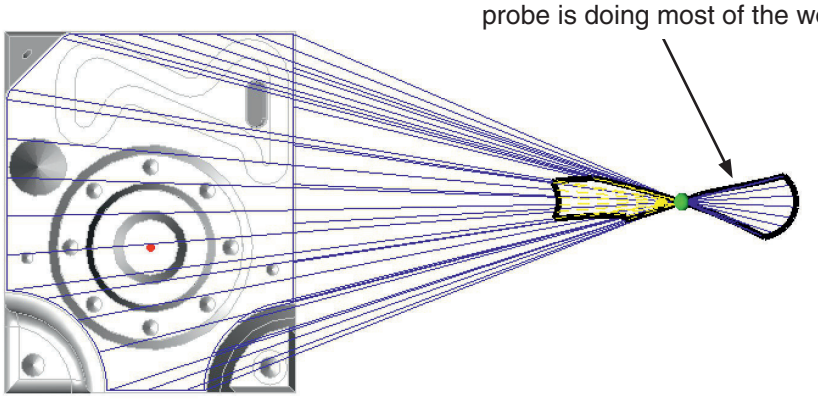
Stylus leader lines



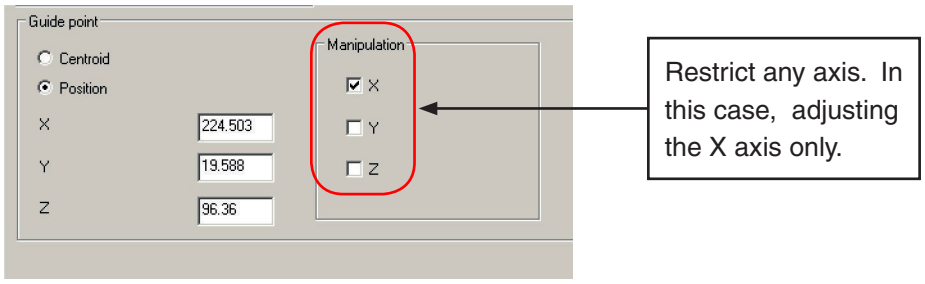
Dragging the guide point further away from the part extends the leader lines, when the lines are longer than the stylus the extensions will appear in yellow.

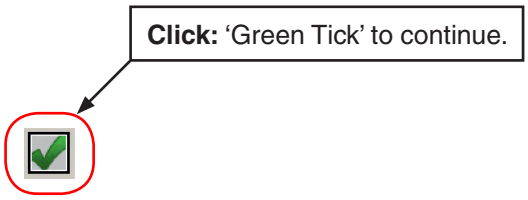
The stylus angle with respect to the feature should be between 0° and 45° for optimum performance.

The black line depicts the movement of the probe head. The smaller the line the more efficient 5 axes moves as the probe is doing most of the work with little CMM movement.

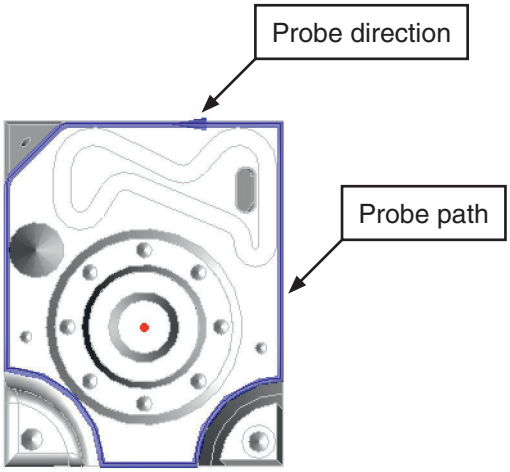


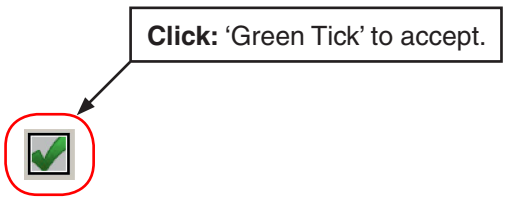
Manipulate point position





The probe path will now be drawn on the model:

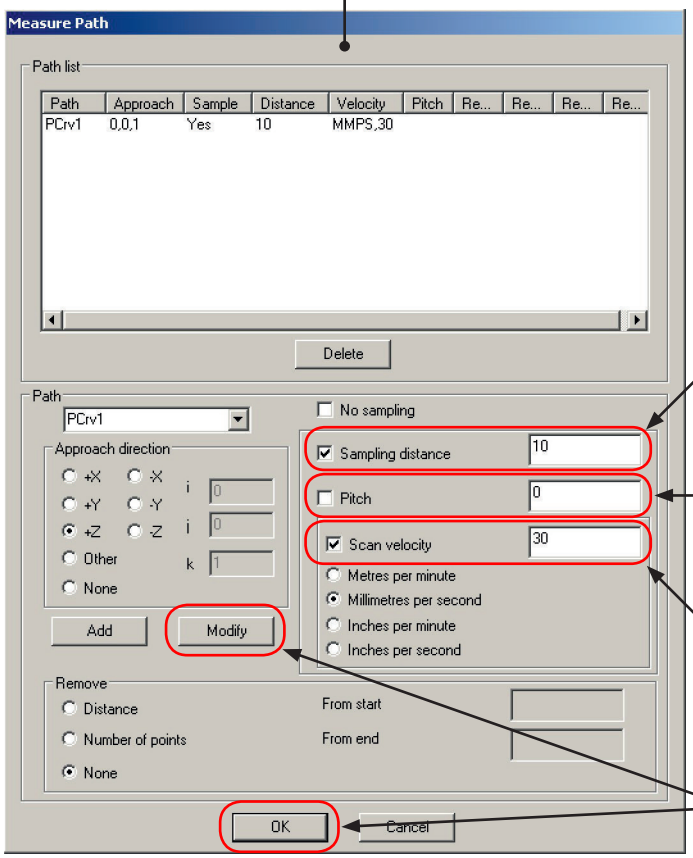




Code produced:

```
P(PCrv1)=PATH/CURVE,PTDATA,-18.511365,-61.5,0,0,0,1,PCS,nnnnnn
F(PLN001)=FEAT/PLANE,CART,0,0,0,0,0,1
MEAS/PLANE,F(PLN001),3
PAMEAS/DISTANCE,10,SCNVEL,MMPS,30,P(PCrv1),0,0,1
ENDMES
```

To change scanning speed and other parameters double click on the PAMEAS line to bring up the parameter editor.



The distance between touch (sample) points on the scan path.

When sweep scanning a surface, the distance between the centre points of sweeps of the scan.

Sweep scanning is covered later in this tutorial.

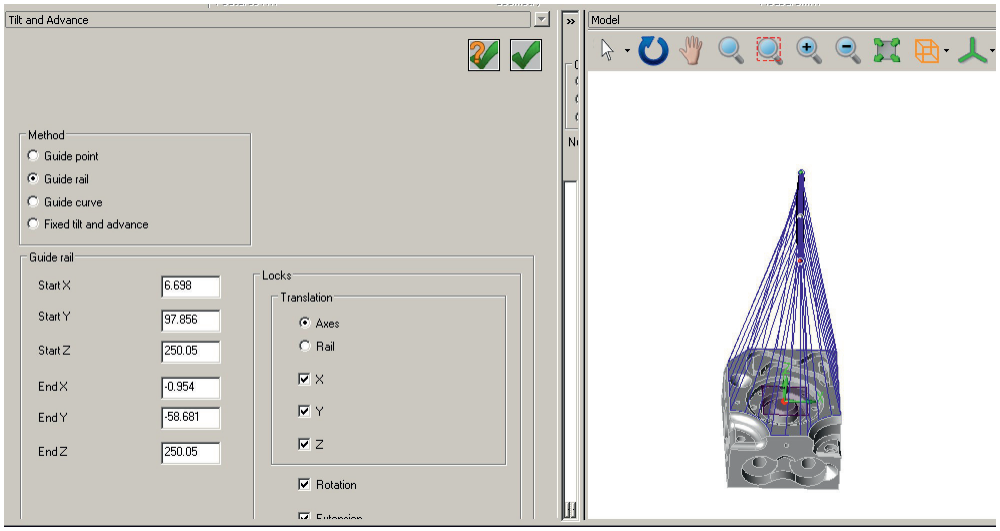
Increase / decrease the scanning speed.

Click: ‘Modify’ after making changes then click ‘OK’.

The plane is scanned as expected.

5 ‘Tilt and Advance’ dialogue box - guide rail

When using this option, leader lines extend from the inspection path and converge on the guide rail. MODUS calculates a default line to use as a guide rail. The direction and length of the guide rail are defined by the largest extent of the inspection path in the plane in which it lies. The guide rail is offset from the plane of the inspection path by the current probe length.

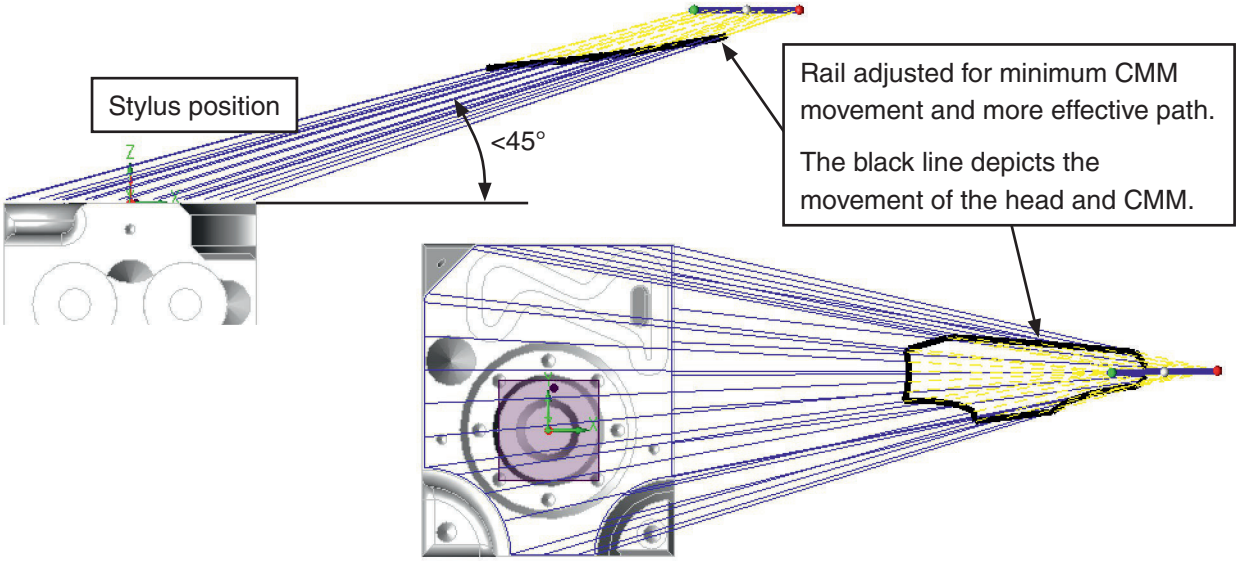


Move rail without any rotation or resizing

To adjust the guide rail click and drag on the required handle:

Rotate rail around green handle

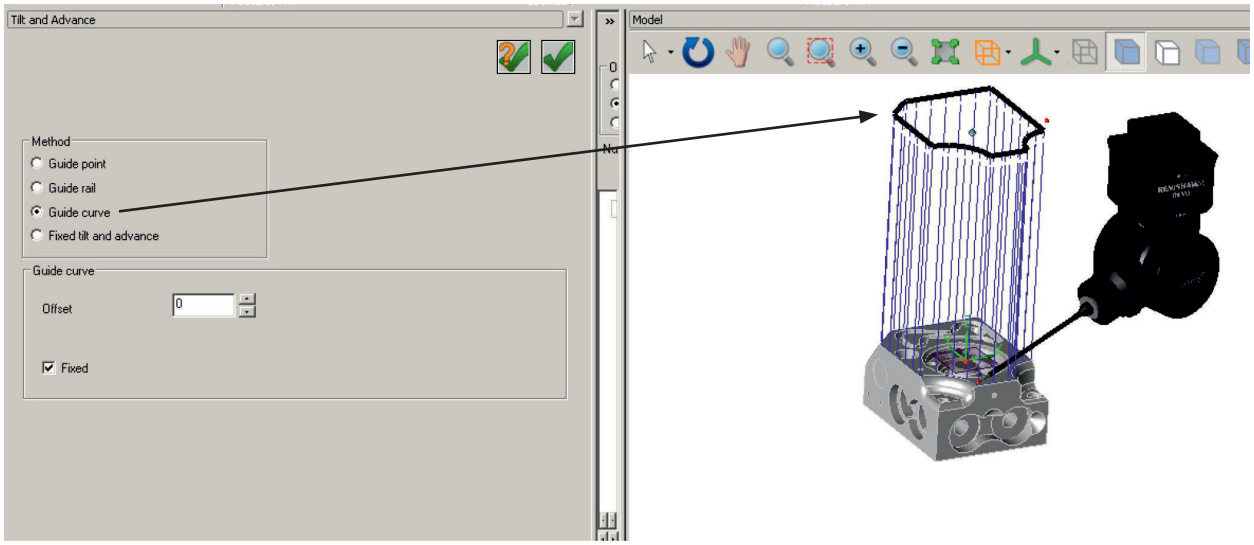
Adjust the rail length

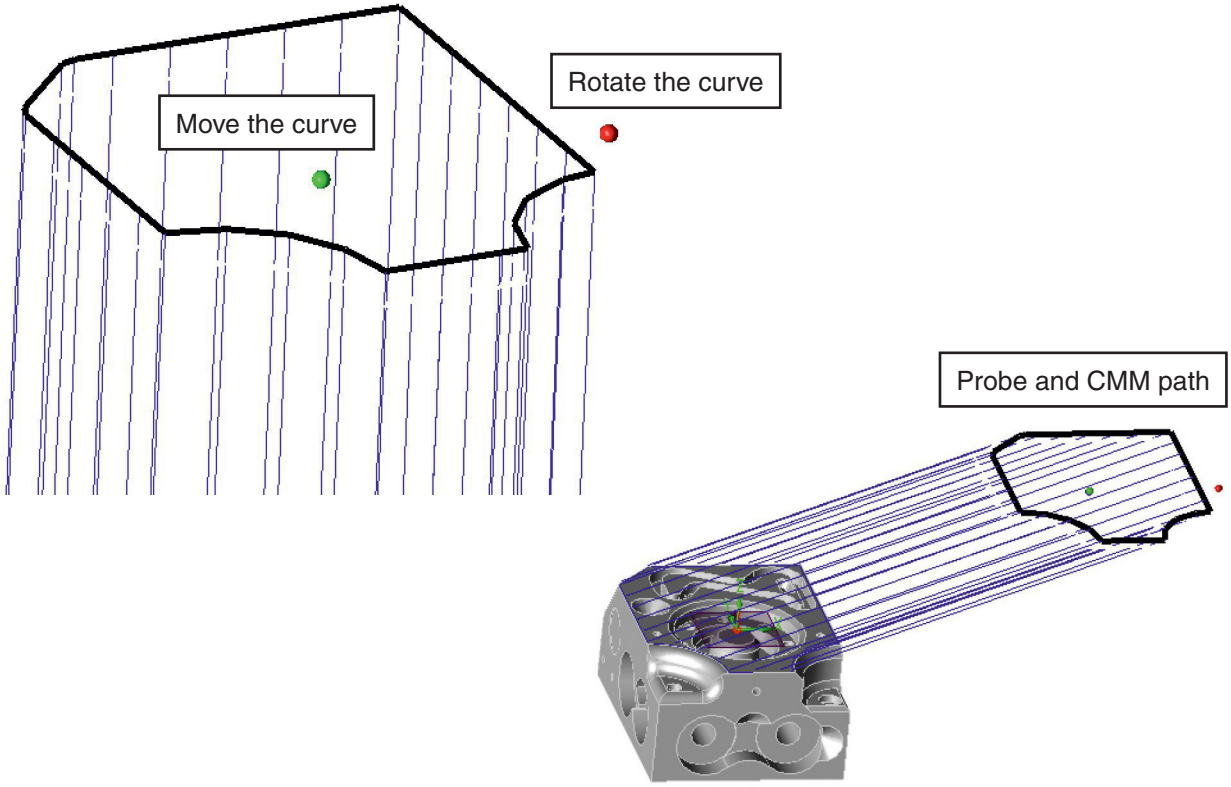


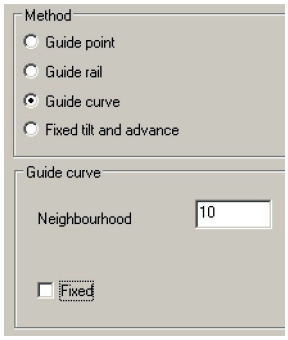
Confirming using the green tick allows the code to be generated.

6 ‘Tilt and Advance’ dialogue box - guide curve

This option projects the inspection path points in space, offsetting each point within the plane of the inspection path by the value in the offset field. The resulting offset curve is then projected along the normal to the plane in which the inspection path lies. MODUS draws a leader line from each point on the inspection path to the equivalent point on the projected offset curve

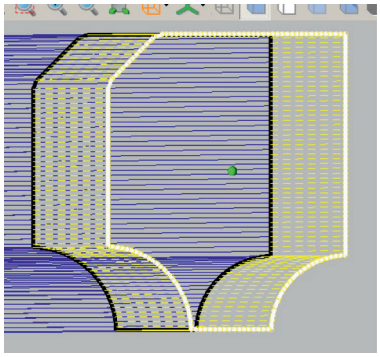




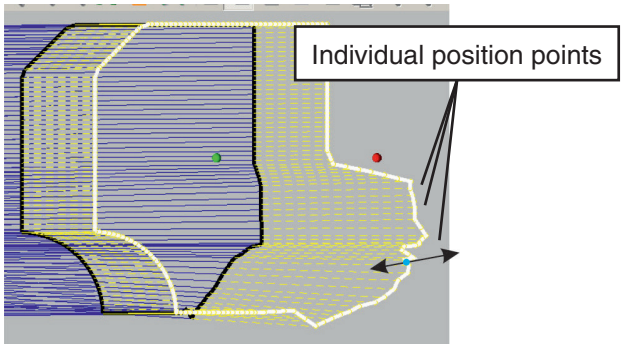


The neighbourhood option allows free-form distortion of the guide curve to adjust the probe motion around obstructions.

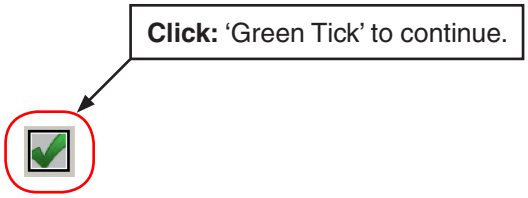
Ensure the 'Fixed' box is unchecked on the 'Tilt and Advance' dialogue box. The 'Neighbourhood' field is then displayed. Type in a number to specify how many adjacent points on the guide curve will be moved when one point is dragged to a new position.



Before

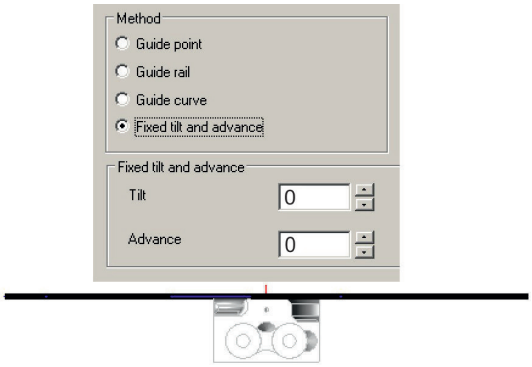


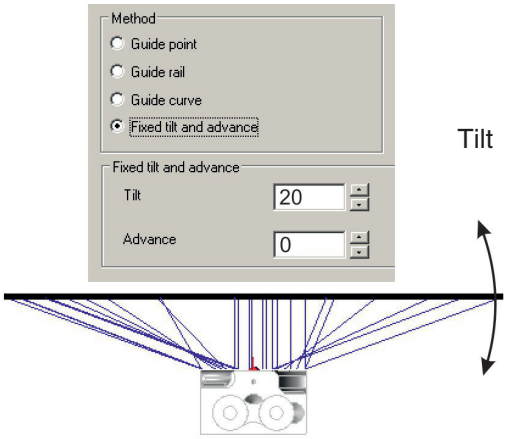
After

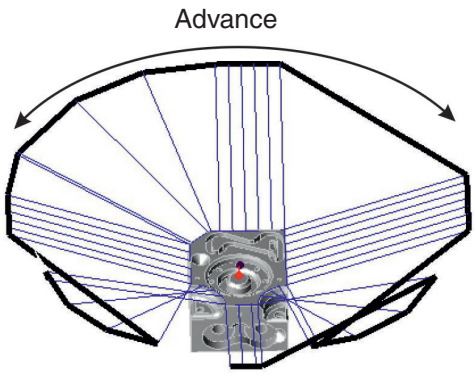


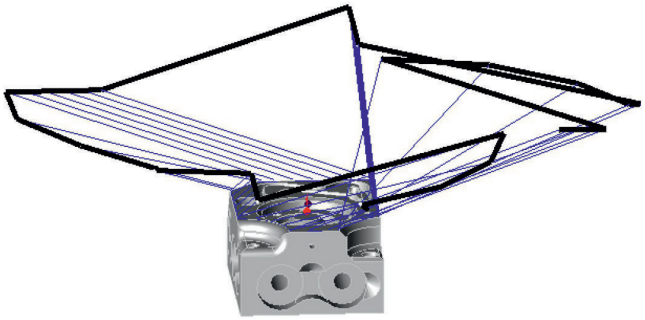
7 ‘Tilt and Advance’ dialogue box - tilt and advance

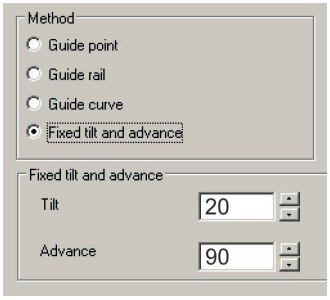
Again, using the ‘Tilt and Advance’ dialogue box, select the ‘Fixed tilt and advance’ option. This is used to maintain the probe orientation relative to the surface during inspection.

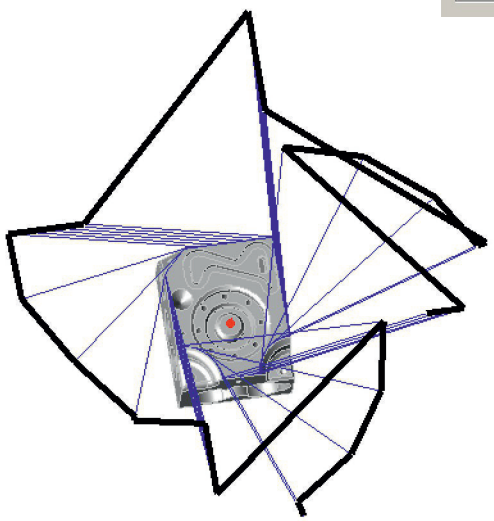












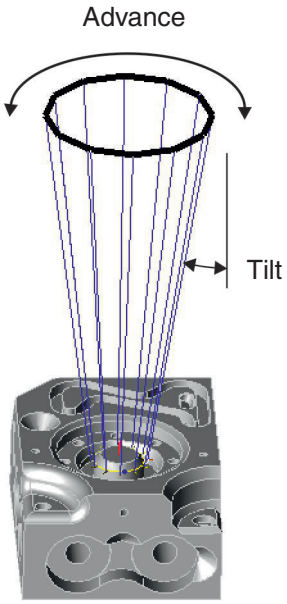
Here there is too much CMM movement.

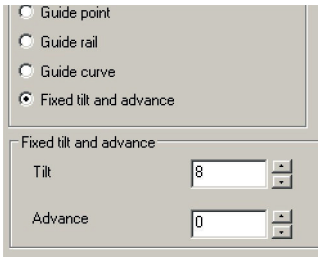
It’s also possible the CMM could try and move outside the machine volume.

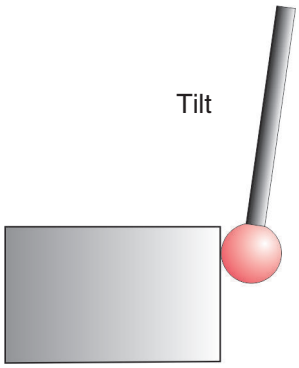
Another method must be used in this case to enable a more efficient use of the system.

Fixed tilt and advance is useful when scanning a boss.

In this case the stylus is required to be offset at an angle to the boss face to avoid shanking.



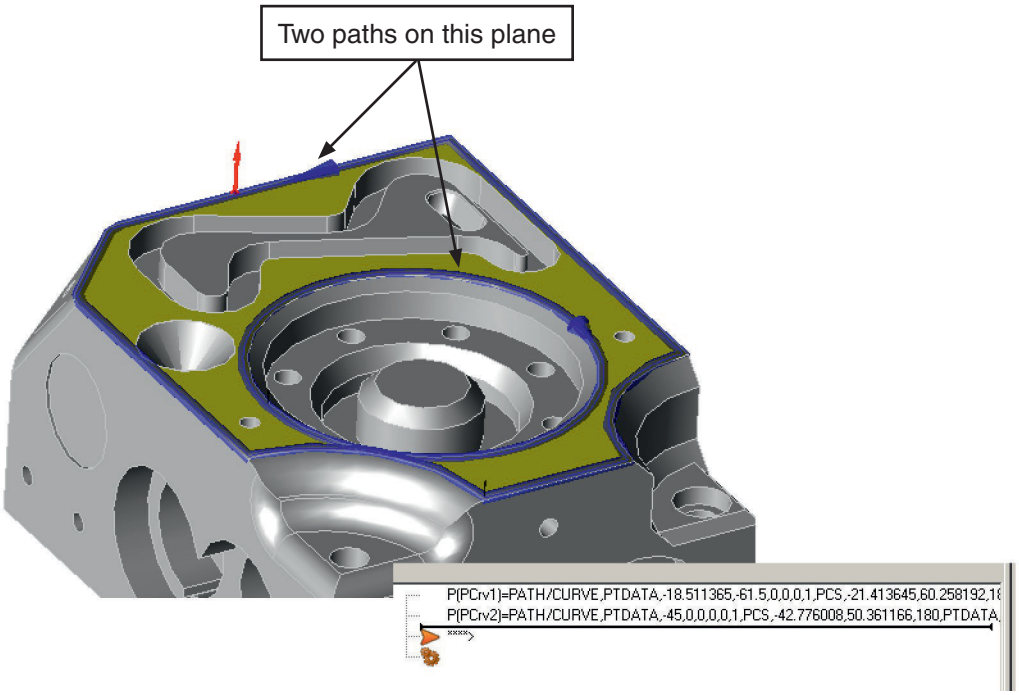




8 Create multiple plane scans within one measurement block

In certain cases more coverage / point collection is desired on a component.

In this case more than one path can be included within a single inspection block.



Inspect - Plane
Scan - Edge Offset
Select first curve - Ok
Adjust Tilt & Advance - Ok
First Path is created

Scan - Edge Offset
Select next curve - Ok
Adjust Tilt & Advance - Ok
Next Path is created

Apply to complete

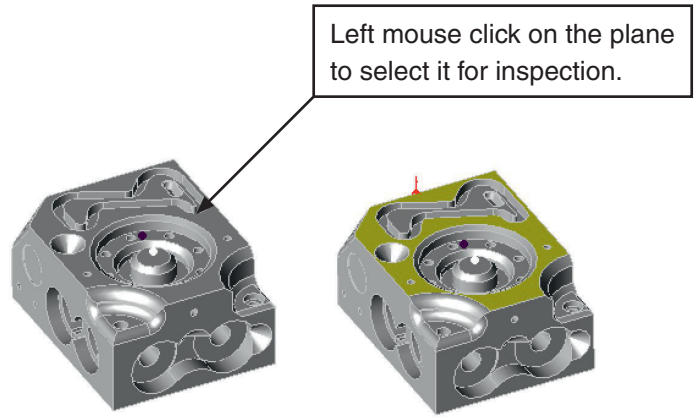
Code produced:

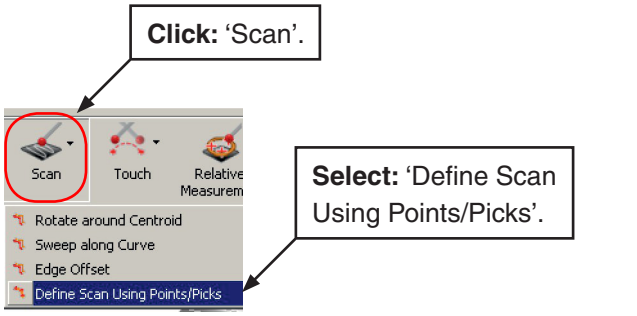
P(PCrv1)=PATH/CURVE,PTDATA,-18.511365,-61.5,0,0,0,1,PCS,-21.413645,nnnn
P(PCrv2)=PATH/CURVE,PTDATA,-45,0,0,0,0,1,PCS,-42.776008,50.361166,180,nnnn

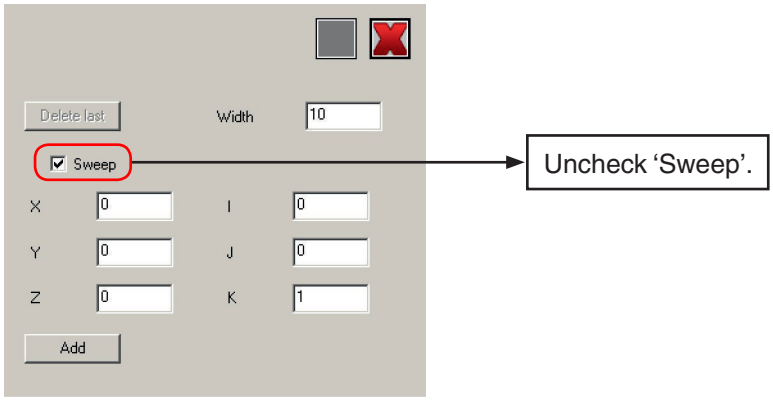
F(TOP_FACE)=FEAT/PLANE,CART,0,92.5,0,0,0,1
MEAS/PLANE,F(TOP_FACE),3
PAMEAS/DISTANCE,9.104,SCNVEL,MMPS,100,P(PCrv1),0,0,1
PAMEAS/DISTANCE,9.104,SCNVEL,MMPS,100,P(PCrv2),0,0,1
ENDMES

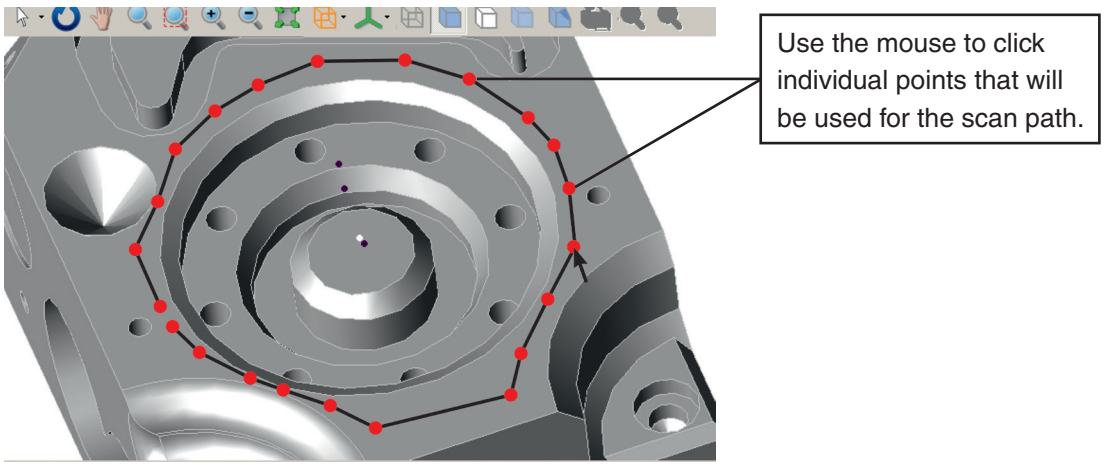
9 Manually define the scan path

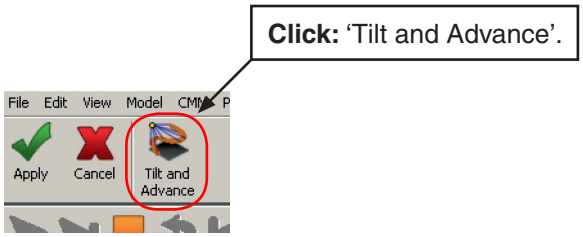
In other cases the user can define their own path coverage using the mouse.





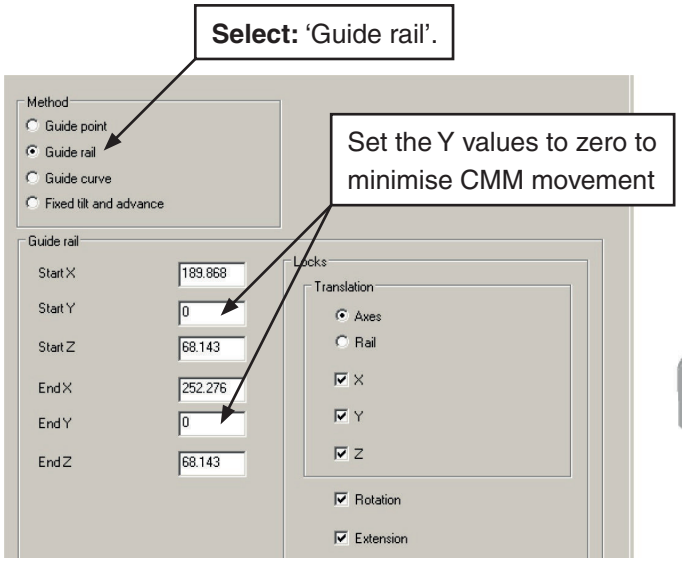


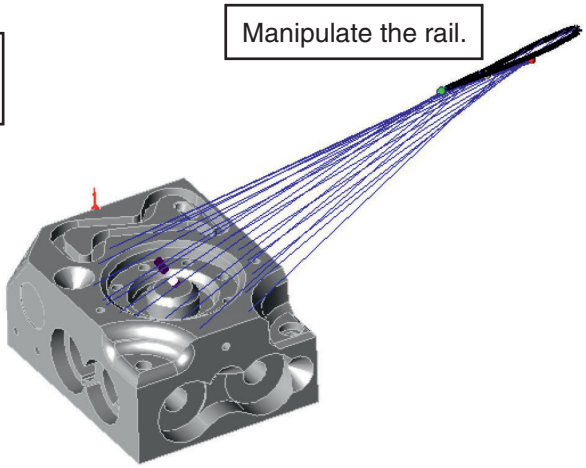


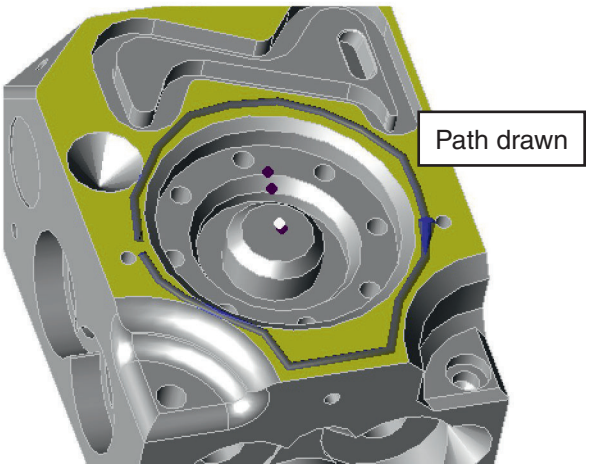


In this case guide point or guide rail is suitable.

GUIDANCE NOTE: Unlike 'Edge Offset' scan, the 'Tilt and Advance' dialogue box does not open automatically after selecting a scan path using points and picks.





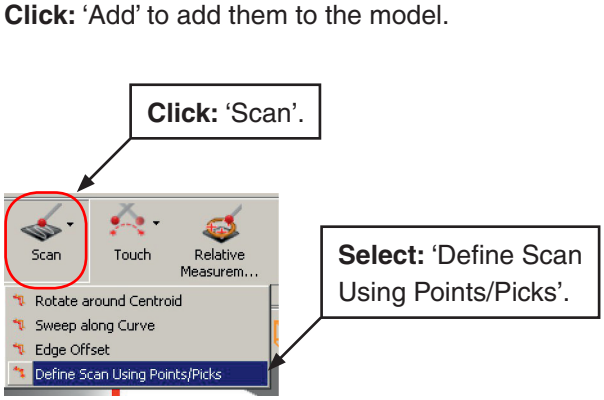


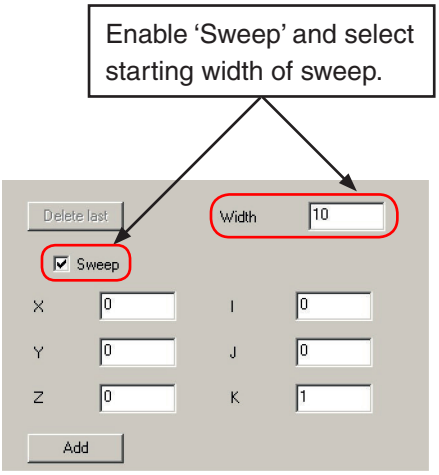
10 Using sweep method

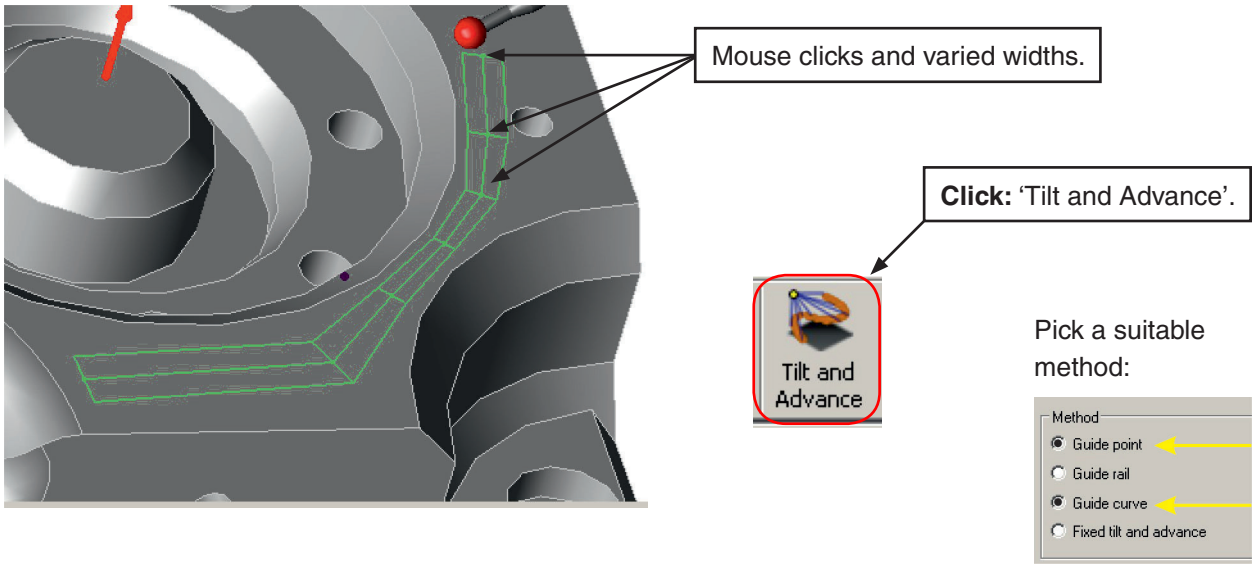
Define the scan path on the model by picking successive points on the model, typing in different sweep widths between points where necessary.

Also, type in the XYZ and IJK values for successive points.

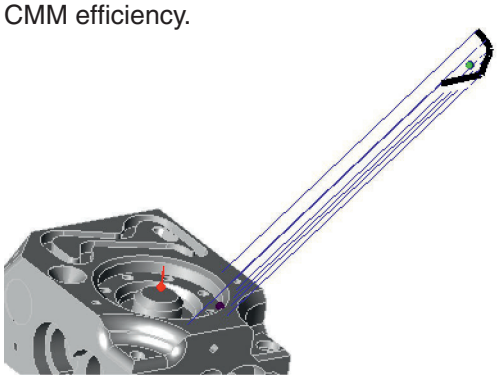
Click: 'Add' to add them to the model.



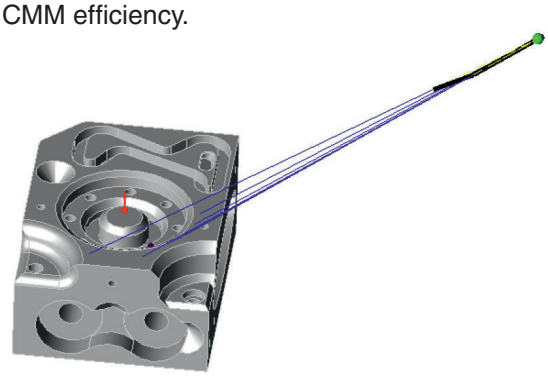




Method A
Manipulate guide curve to maximise probe and CMM efficiency.



Method B
Manipulate guide point to maximise probe and CMM efficiency.



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